

Research paper

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Parenting, School Contexts and Violent Delinquency

by Robin Fitzgerald



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- . not available for any reference period
- .. not available for a specific reference period
- ... not applicable
- 0 true zero or a value rounded to zero
- 0^s value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
- P preliminary
- r revised
- x suppressed to meet the confidentiality requirements of the *Statistics Act*
- E use with caution
- F too unreliable to be published

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Abstract

This study examines the relationship between parental monitoring and youth violent delinquency, as well as the extent to which this relationship may be influenced by the school context. The study is based on data from the International Youth Survey (2006) which gathered information from a sample of students in grades 7, 8 and 9 attending Toronto schools. Findings indicate that a low level of parental monitoring is associated with a higher likelihood of youth violent delinquency, and this effect is stronger when youth attend schools where the prevalence of delinquency among the student population is high. This finding supports the hypothesis that the negative influence of low parental monitoring is magnified when youth are also exposed to a pool of delinquent peers, and further suggests that the effectiveness of particular parenting strategies may vary depending on the environments to which youth are exposed.

Parenting, School Contexts and Violent Delinquency

by Robin Fitzgerald

1 Introduction

Numerous studies have demonstrated that parenting practices are associated with various forms of delinquent behaviour among youth. In particular, parental monitoring—or knowing where one's child is and who they spend time with—has been linked to lower rates of youth delinquency and violent behaviour (Brendgen, Vitaro, Tremblay and Lavoie, 2001; Patterson and Stouthamer-Loeber, 1984).

Another line of research has acknowledged that parenting does not occur in isolation; rather children and youth are exposed to many contexts beyond the home that may influence the relationship between parenting strategies and youth behavioural outcomes (Simons et al., 2002). Much of this research has focussed on the influence of communities and neighbourhoods on families (Brooks-Gunn, Duncan and Aber, 1997; Furstenberg, Cook, Eccles, Elder, and Sameroff 1999; Simons et al., 1997). Although the school environment represents a primary influence for school-aged children and youth (Gottfredson, Gottfredson, Payne and Gottfredson, 2005; Payne 2008), the influence of this context on the relationship between parenting and youth delinquency has not been examined.

This study builds upon previous research to look at the possible influence of the school context—and in particular the level of vandalism, theft, violence and drug use perceived by students while at school—on the relationship between parental monitoring and youths' chances of engaging in violent delinquency. Put differently, the study is concerned with examining the possibility that parenting strategies may vary in their effect on youth violent behaviour depending on the school context to which the youth is exposed. Analyses are based on data from the International Youth Survey (IYS 2006) which gathered information from students in grades 7, 8 and 9 attending a sample of Toronto schools (see 'Data source' in the Methodology section).

2 Background

2.1 The role of parental monitoring

The relationship between parental monitoring and youth violence has been demonstrated in a number of studies. Brendgen et al. (2001) used data from a Montreal longitudinal study of boys to show that parental monitoring reduced the likelihood that early adolescent aggressive behaviour would develop into subsequent delinquency-related violence. More specifically, when boys reported that their parents infrequently knew where and with whom they spent time when outside of the home, boys' early aggression at ages 13 to 15 were predictive of violent delinquency at ages 16 and 17.

The particular importance of the association between poor parental monitoring of the kinds of companions with whom youth spend time and subsequent violent behaviour in youth has been noted in a number of studies (Brendgen et al., 2001; Dodge, 1991; Patterson and Stouthamer-Loeber, 1984; Poulin and Boivin, 2000). This research suggests that since aggressive youth are more likely to associate with aggressive peers, violent behaviour may be reinforced. Thus, poor parental monitoring will present aggressive youth far greater "opportunity for deviant affiliations" with other aggressive peers, "...implicitly paving the way for violent and delinquent behaviour" (Brendgen et al., 2001, 302).

2.2 The link between neighbourhood contexts, parenting strategies and youth violence

Despite the strong research evidence of a direct link between parenting strategies and youth behavioural outcomes, some research suggests there is reason to consider the influence of the broader community context on this relationship. There is ample evidence that parenting strategies vary across different types of communities (Brooks-Gunn, Duncan and Aber, 1997; Furstenberg, et al., 1999; Jarrett, 1997). Simons et al. (2002) have taken this line of reasoning one step further to consider whether the effect of parenting strategies on youth behaviour also varied according to the neighbourhood context.

They found that the deterrent effect of "caretaker control"—a broad measure of monitoring which included the extent to which parents knew with whom their children spent time—on youth conduct problems was weaker in some neighbourhood contexts than others. Specifically, as the neighbourhood level of crime and physical disorder increased, the effectiveness of caretaker control on youth problem behaviour diminished. Simons et al., (2002) argue that their finding suggests that monitoring and disciplinary practices that are effective in neighbourhoods with low or moderate levels of crime and other forms of deviancy may not be sufficient to prevent child delinquency in higher crime neighbourhoods. In these places, "delinquent opportunities and pressures from deviant peers may overwhelm a parent's ability to prevent his or her child from participating in antisocial behaviour" (Simons et al., 2002, 341).

2.3 The importance of the school context

Research has underlined the importance of the school context in understanding youth outcomes (Gottfredson, 2001; Gottfredson, et al., 2005; Fitzgerald, 2009; Payne 2008; Payne, Gottfredson and Gottfredson, 2003; Welsh, Greene and Jenkins, 1999). For instance, more 'communal school' environments, characterised by a supportive and collaborative school climate, have been shown to be associated with a decreased risk of youth engaging in delinquency (Payne, 2008). On the contrary, schools characterized by higher levels of victimization and student delinquency, or what Welsh et al. (1999) and others (Gottfredson, et al., 2005) have referred to as school 'disorder' are associated with poor student outcomes.

Exposure to peer behaviours in the school setting has implications for the development of youth violent behaviour. For example, Haynie, Silver and Teasdale (2006) found that exposure to peer fighting was strongly associated with youths' subsequent participation in serious violence. In contrast, exposure to academically oriented peers was associated with a reduction in violent behaviour. They propose that "peer behaviours signal entry into delinquent subcultures in which peer based social controls against violence are weak" (Haynie et al., 2006, 164).

3 The current study

To address gaps in the current research, this study examines whether the relationship between youth violent delinquency and parental monitoring (i.e., tracking with whom youth spend time when they are away from the home) varies across schools, and whether this variation is explained by school-level delinquency (a measure of the perceived level of vandalism, theft, violence and drug-use) (see 'Variables' in the Methodology section). Analyses are based on IYS (2006) respondents in grades 7 to 9 ($n = 3,184$) attending Toronto schools ($n = 149$).

The International Youth Survey (IYS) was designed so that information was collected from multiple students within each school in the sample. It is likely that students attending the same school may share experiences that lead them to be more similar to each other than to those attending other schools. Thus, students with similar individual characteristics may have different chances of engaging in violent delinquency depending on the particular conditions in the schools that they attend. To the extent that this is the case, some portion of the delinquency differences between students could be attributable to the school context. To statistically account for this possibility, multilevel modelling was used in this study (for further details see 'Multilevel analysis' in the Methodology section).

Multilevel model results are presented in two sections. In the first set of models (Table 2), parental monitoring is the outcome variable and analyses examine (1) whether the average level of parental monitoring varies across schools, and (2) whether school-level delinquency is associated with higher or lower levels of parental monitoring in a school.

In the second set of models (Table 3), youth violent delinquency is the outcome variable and analyses examine (1) whether violent delinquency varies across schools, (2) whether low parental monitoring is associated with a greater likelihood of youth involvement in violent delinquency, (3) whether school-level deviancy is associated with a greater likelihood of youth involvement in violent delinquency, (4) whether the relationship between parental monitoring and youth violent delinquency varies across schools, and finally (5) whether school-level delinquency explains differences between schools in the relationship between violent delinquency and parental monitoring.

4 Findings

The distribution of study variables are presented in Table 1. Overall, slightly more than one-third (34%) of youth in the sample indicated that their parents were low monitors—or 'never', 'rarely' or 'sometimes' knew with whom they spent time when they went out. There were gender and grade-level differences in youths' reports of parental monitoring. A greater proportion of males (38%) than females (30%) reported that their parents were low monitors, and the proportion of youth reporting low monitoring increased with each grade-level (26%, 35%, and 42%, respectively).

Table 1
Distribution of study variables

	Weighted ³ percent	Standard error	Weighted population estimate	Percent of each group with low monitoring parents
	percent		number	percent
Individual-level variables¹				
Parental monitoring				
Low	34.3	1.03	20,200	...
High ²	65.7	1.03	38,700	...
Gender				
Male	51.8	0.95	30,500	38.42 [*]
Female ²	48.3	0.95	28,400	29.9
Grade level				
Grade 7	32.6	0.97	19,200	25.51 [*]
Grade 8	33.3	1.31	19,600	34.7 [*]
Grade 9 ²	34.0	0.95	20,000	42.4
Violent delinquency				
Yes	15.3	0.88	9,000	62.8 [*]
No ²	84.7	0.88	49,800	29.2
Total youth sample	100.0	...	58,900	...
	mean	standard error	minimum	maximum
School-level variable				
School delinquency score	2.24	0.03	1.10	3.29

^{*} statistically different from the reference category $p \leq 0.05$

1. For precise variable definitions see 'Variables' in the Methodology section.

2. Reference category in models.

3. Percentages may not add to 100% due to rounding.

Note(s): Population estimate rounded to the nearest 10; sample size = 3,184 grade 7 to 9 students attending 149 Toronto schools.

Source(s): Statistics Canada, International Youth Survey, 2006.

About 15% of youth in the sample indicated that they had committed at least one of six violent acts within the past year (see 'Variables' in the Methodology section). A considerably larger proportion (63%) of those who were involved in violent delinquency also reported that their parents were low monitors than was the case for their non-violent counterparts (29%).

Among the 149 schools in the sample, the mean school-level delinquency score was 2.2 and ranged from 1.1 to 3.3 where higher scores represented a higher level of school-level delinquency. This variable was based on the average responses of the students in each school to a range of questions about their perceptions of various deviant behaviours committed by others in the school. To avoid possible bias resulting from having the same individuals providing information about their own violent delinquent outcomes and the school context, a "non-self" mean score was calculated based on recommendations by McQuestion (2003) (see 'Variables' in the Methodology section).

4.1 Variation in parental monitoring across schools

4.1.1 Does low parental monitoring vary significantly across schools?

As a first step, an 'empty model' was calculated to examine the extent to which youths' reports of low parental monitoring varied across schools (Table 2). This model contains no covariates, but simply calculates the magnitude of the variation between schools in low parental monitoring. All variance and standard error estimates for models were calculated using a multilevel weighting scheme developed by Statistics Canada (Pierre and Saidi, 2008; see 'Weighting procedures' in the Methodology section).

Table 2
Variation in low parental monitoring across schools

Dependent variable: low parental monitoring	Empty model	Individual- and school-level model
	odds ratio	
Fixed effects		
Intercept	0.44 *	0.30 *
School-level characteristics		
School delinquency score	ns	1.34 *
Individual-level characteristics		
Gender		
Male	ns	1.16
Female ¹	ns	1.00
Grade level		
Grade 7	ns	0.57 *
Grade 8	ns	0.83
Grade 9 ¹	ns	1.00
	variance	
Random effects		
Variance (Intercept)	0.107 *	0.059
	percent	
Prevalence and variation across schools ²		
Average likelihood in a 'typical' school	30.7	23.3
Low prevalence	18.9	15.9
High prevalence	45.6	32.8

* $p \leq 0.05$

1. Reference category.

2. See details on calculation of prevalence and variation across schools in "Calculating between-school variation in prevalence of parental monitoring and violent delinquency" in the Methodology section.

Note(s): Sample size = 3,184 grade 7 to 9 students attending 149 Toronto schools.

Source(s): Statistics Canada, International Youth Survey, 2006.

Results showed a statistically significant amount of between-school variation in the probability of youth reporting that their parents were low monitors (0.107, $p < 0.05$). This means that in an average school, about 31% of youth reported that their parents never or rarely knew who they were with when they went out. However, there was substantial variation in this figure which ranged from a low of about 19% of youth in a school to a high of 46%. About 95% of

schools lay within this range (see 'Calculating between-school variation in prevalence of parental monitoring and violent delinquency' in the Methodology section).

4.1.2 Is school-level delinquency associated with low parental monitoring?

Results from the second model in Table 2 show a reduction in the between-school variation in low parental monitoring when school-level delinquency and individual-level gender and grade-level control variables are taken into account. In this model, the between-school variance in low parental monitoring decreased by 45% (from 0.107, $p > 0.1$ to 0.059, $p > 0.1$ in the second model) and became statistically non-significant.

The model also indicated that there was a relationship between school-level delinquency and low parental monitoring. Youth attending schools with higher levels of school delinquency had higher chances of reporting that their parents were low monitors. More specifically, after accounting for a youth's gender and grade level, each one-unit increase in the school delinquency score increased the odds of low parental monitoring by about 34% ($p < 0.05$).

4.2 Variation in violent delinquency across schools

4.2.1 Are there differences between schools in self-reported violent delinquency?

Empty model results in Table 3 show that there was a statistically significant between-school variation in the probability of self-reported violence among youth in the sample (0.21, $p < 0.05$). In the average school, about 13% of grade 7 to 9 youth reported past-year violent delinquency, and this prevalence rate ranged from a low of about 6% to a high of about 27% of students (about 95% of schools lay within this range).

4.2.2 Is low parental monitoring associated with higher chances of self-reported violent delinquency?

The second model in Table 3 includes the individual-level covariates gender, grade-level and low parental monitoring. Consistent with other research, these results show that males were more likely than females to have reported engaging in violence. In this case, males had odds of self-reported violent delinquency over two times higher than females. Younger youth were more likely than older youth to report violent delinquency. In particular, grade 8 students had odds about 43% higher than grade 9 students (the reference category). The results also show a strong relationship between parental monitoring and violent delinquency after accounting for youths' gender and grade-level. The odds of self-reported violent delinquency for youth who indicated that their parents were low monitors were 4.9 times higher ($p < 0.05$) than those who reported that their parents were high or consistent monitors.

4.2.3 Is school-level delinquency associated with higher chances of self-reported violent delinquency?

The third model shows that, after accounting for a student's gender and grade-level, attending a school with a higher level of school-delinquency was associated with a greater risk of self-reported violent delinquency. Specifically, for each one-unit increase in the school-delinquency score the odds of self-reported violent delinquency doubled (odds ratio = 2.13, $p < 0.05$). This finding demonstrates that some portion of the differences between youth in their likelihood of being violent is attributable to the school context, and particularly to the extent to which there is an available pool of other delinquent youth with whom to engage.

Table 3
Variation in violent delinquency across schools

Dependent variable: violent delinquency	Empty model	Parental monitoring model	School-level delinquency model	Full model
	odds ratio			
Fixed effects				
Intercept	0.15 **	0.04 **	0.1 **	0.03 **
School-level characteristics				
School delinquency score	...	...	2.13 **	...
Individual-level characteristics				
Gender				
Male	...	2.14 **	2.04 **	2.14 **
Female ¹	...	1.00	1.00	1.00
Grade level				
Grade 7	...	1.21	1.14	1.40 **
Grade 8	...	1.43 **	1.53 **	1.69 **
Grade 9 ¹	...	1.00	1.00	1.00
Parental monitoring				
Low	...	4.92 **	...	1.67 **
High ¹	...	1.00	...	1.00
Cross-level interaction				
School delinquency x low parental monitoring	...	...	...	1.7 **
	variance			
Random effects				
Variance (Intercept)	0.21 **	0.13 **	0.1 *	0.42 **
Covariance (Intercept, low parental monitoring)	...	...	...	-0.39 **
Variance (Low parental monitoring)	...	...	...	0.37 **
	percent			
Prevalence and variation across schools²				
Average likelihood in a 'typical' school	13.18	...	...	...
Low prevalence	5.77	...	...	...
High prevalence	27.35	...	...	...

* $p \leq 0.1$

** $p \leq 0.05$

¹ Reference category.

² See details on calculation of prevalence and variation across schools in "Calculating between-school variation in prevalence of parental monitoring and violent delinquency" in the Methodology section.

Note(s): Sample size = 3,184 grade 7 to 9 students attending 149 Toronto schools.

Source(s): Statistics Canada, International Youth Survey, 2006

4.2.4 Does school-level delinquency explain differences between schools in the relationship between violent delinquency and parental monitoring?

The final model in Table 3 provides information about whether or not the relationship between low parental monitoring and violent delinquency varied across schools. In addition, the model estimated the extent to which school-level delinquency predicted between-school variation in the relationship between low parental monitoring and self-reported violent delinquency—i.e., a cross-level interaction between monitoring and school delinquency.

To begin with, the results show that the strength of the relationship between parental monitoring and violent delinquency did vary across schools (variance parental monitoring = 0.37, $p < 0.05$). Put in other words, low parental monitoring was a stronger predictor of self-reported violent delinquency in some schools than in others.

The estimate for the cross-level interaction was positive and significant (odds ratio = 1.7, $p < 0.05$) showing that the association between low parental monitoring and youths' greater chances of involvement in violent delinquency became even stronger as the level of delinquency in the schools they attended increased.

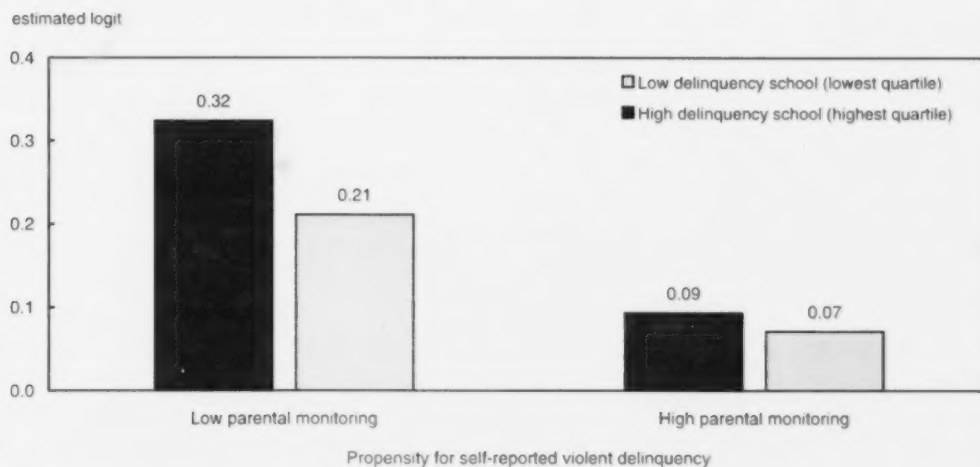
To illustrate this finding, Figure 1 shows the relationship between parental monitoring and the likelihood of youth involvement in violent delinquency for those attending schools with the highest and lowest levels of

school-delinquency. More specifically, for the purposes of illustration the relationship between parental monitoring and violent delinquency is shown only for the typical school falling into the lowest quartile of school-delinquency (light bars) and the typical school falling into the highest quartile of school-delinquency (dark bars). The figure shows that, overall, youth have a greater likelihood of involvement in self-reported delinquency when their parents are low monitors than when they are high monitors, regardless of the school-delinquency context. However, when youth with low monitoring parents attend schools with the highest levels of delinquency, their chances of involvement in violent delinquency are far greater than when they attend schools with the lowest levels of delinquency.

The figure also indicates that although a high level of parental monitoring does not completely counteract the influence of a negative school environment, the effect is substantially lower than for youth whose parents are considered to be poor monitors.

Chart 1

Association between parental monitoring and self-reported violent delinquency for youth attending schools with high or low levels of school-delinquency



Source(s): Statistics Canada, International Youth Survey, 2006

5 Discussion

The aim of this study was to extend previous research on the influence of parental monitoring on youth violent delinquency. Many studies have shown a strong association between parenting practices and youth behavioural outcomes. In particular, consistent parental monitoring—or knowing where one's child is and who he or she is with—has been demonstrated to reduce youth chances of involvement in delinquency and violent behaviour (Brendgen et al., 2001; Dodge 1991; Patterson and Stouthamer-Loeber, 1984; Poulin and Boivin, 2000). Nonetheless, another line of research has suggested that the strength of the relationship between parenting practices such as monitoring and youth behaviour is to some degree shaped by the neighbourhood or community contexts to which youth are exposed (Simons et al., 2002).

For school-aged children and youth, the school environment represents a particularly important context where delinquent behaviour can be modelled or encouraged. This study adds to previous research by investigating the possibility that the effect of parental monitoring on youth violent behaviour varies depending on the type of school context that the youth must negotiate. In particular, the study considered whether the strength of the relationship between parental monitoring and youth violent delinquency changed when youth attended schools with higher and lower levels of student delinquency.

Results showed that there was substantial between-school variation in the probability of youth reporting that their parents were poor monitors. In an average school, about 31% of youth reported that their parents never or rarely knew who they were with when they went out and this figure ranged from about 19% to 46% of youth in a school. This finding adds further support to the body of research evidence demonstrating that parenting strategies vary according to the community and/or neighbourhood conditions (Brooks-Gunn, Duncan and Aber, 1997; Furstenberg, et al., 1999; Jarrett, 1997).

The results also showed a strong relationship between low parental monitoring and violent delinquency after accounting for youths' gender and grade-level. The odds of self-reported violent delinquency for youth who indicated that their parents were poor monitors were 4.9 times higher ($p < 0.05$) than those who reported that their parents were consistent monitors. However, the strength of the relationship between parental monitoring and violent delinquency varied across schools. Put in other words, low parental monitoring was a stronger predictor of self-reported violent delinquency in some schools than in others.

Finally, the findings in this study demonstrated that youth have a greater likelihood of involvement in self-reported delinquency when their parents use a low level of monitoring than when they use a higher level regardless of the school context. However, when youth with low monitoring parents attend schools with the highest levels of delinquency, their chances of committing violent acts are far greater than when they attend schools with the lowest levels of delinquency. This finding is in line with Simons et al., (2002) who found that higher neighbourhood crime and physical disorder were associated with a reduction in the effectiveness of caretaker control on youth problem behaviour. This, they argue, suggests that monitoring and disciplinary practices that are effective in contexts with low or moderate levels of crime and other forms of deviancy may not be sufficient to prevent youth delinquency in higher crime and deviancy contexts.

This study represents a preliminary look at school differences in the association between parenting practices and youth delinquency. Analyses were based on information about youth attending schools in Toronto, and as a result, further research would need to be undertaken to generalize the findings to other places in Canada. Nonetheless, the findings do point to the importance of accounting for the school environment when considering strategies to reduce problem behaviour in youth. In particular, evidence in this paper suggested that Toronto schools with higher concentrations of antisocial behaviour increased the probability of youth violent delinquency. This is in line with previous research claims that exposure to delinquent peers facilitates the development and enforcement of a subculture of peer violence and delinquency (Haynie et al., 2006; Stark, 1987). The findings also demonstrate that effective monitoring of youth, although beneficial as a deterrent to aggressive behaviour, must be supported by other activities that are targeted to changing the school environment that serves to encourage deviant behaviour in youth.

6 Methodology

6.1 Data source

6.1.1 International Youth Survey (IYS)

The IYS was administered to a sample of students in grades 7 through 9 in Toronto. The survey included youths attending public schools in the Toronto District School Board or private schools in the Toronto metropolitan area in April and May 2006. In addition to a number of delinquent behaviours, the survey content covered a range of factors previously demonstrated to be associated with delinquency from individual, family, peer, school and neighbourhood domains.

The target population represented about 60,000 students. It excluded students from the Toronto Catholic School Board since this board declined to participate in the study. Students from the Catholic Board were estimated to represent roughly 25% of the student population in the Toronto metropolitan area. Also excluded were youths who had dropped out of school or who attended special schools.

The IYS data were gathered using a stratified sampling design. Based on consultation, Statistics Canada used two variables for stratification—grade and two geographic areas—resulting in six strata. The geographic areas were based on postal codes and were split in such a way as to ensure, as much as possible, equal student populations. In each stratum, schools were selected systematically with probability proportional to size, with the size measure being the school enrolment count for the grade of interest. Selection of classes was accomplished in the field by the Statistics Canada interviewer who randomly selected one class in the desired grade. For further details about stratification and sample selection see Statistics Canada (2006). In total, 4,497 students were selected from 176 responding schools. Of this number, 3,290 students (or about 73% of students) attending 149 schools completed the survey. In some cases students agreed to complete the survey but did not complete all survey items. As a result of this item non-response, the final sample size in this study was 3,184 students from 149 schools. Students completed the IYS survey in the classroom.

6.2 Variables

6.2.1 Outcome measure (violent delinquency)

Violent delinquency: a two-category outcome variable for which students were scored 1 if they reported committing at least one of six violent acts at least once in the past 12 months, and 0 if they reported none of the acts. Students were asked: "Have you ever participated in a group fight on a school playground, a football stadium, in a street, or in any other public place?"; "Have you ever threatened somebody with a weapon or threatened to beat them up to get money or other things from them?"; "Have you ever carried a weapon, such as a stick, chain, or knife (not a pocket knife)?"; "Have you ever snatched a purse, bag or something else from a person?"; "Have you ever intentionally beaten up someone, or hurt them with a stick or knife, so badly that they had to see a doctor?"; or "Have you ever sent e-mail messages intending to harass or frighten the other person?".

6.2.2 Student-level variables

Gender: coded 1 for male and 0 for female.

Grade-level: to represent the three grade levels (7, 8 and 9) two binary dummy variables were coded for grades 7 and 8, with grade 9 serving as the reference category.

Low parental monitoring: a binary variable measuring students' assessments of parental monitoring. Students were asked: "Do your parents (or the adults you live with) usually know who you are with when you go out?" where possible responses included "Always," "Sometimes," "Rarely/Never," or "I don't go out." Students were coded 1 for "Sometimes," or "Rarely/Never" or 0 for "Always" or "I don't go out". Students who indicated that they did not go out at night were retained in this variable because they represented a relatively large proportion of the analytic sample (6%), and they were highly correlated with students who indicated that their parents always knew with whom they went out.

6.2.3 School-level variable: School-level delinquency

Ideally, when measuring the influence of larger contexts such as schools or neighbourhoods on individual behaviour and outcomes, one would use information from sources other than the survey measuring the outcome, for example, the Census or Incident-based Uniform Crime Reporting Survey (UCR2). In this study, a measure of the school context was based on the aggregated (averaged) responses of the students attending each school who were also providing information about their own violent behaviour and parental monitoring. To avoid possible bias resulting from having the same individuals providing outcome and context information, a "non-self" mean score was calculated based on recommendations by McQuestion (2003). In this case, each student's score excluded his or her own assessment of school-level delinquency, but included the average score for the 'other' students in the school across four school-level delinquency items. These items included:

- "Many things are broken or vandalised in my school",
- "There is a lot of stealing in my school",
- "There is a lot of fighting in my school", and
- "There is a lot of drug use in my school".

The resulting non-self mean school-delinquency score ranged from 1.1 to 3.29 where a higher score represented a higher level of school-delinquency. Before estimating the multilevel models, this variable was centred around the grand mean, or the mean of school means (Raudenbush and Bryk 2002, 31 to 35).

6.3 Multilevel analysis

In the study, students were grouped within schools. Statistically, it is necessary to use techniques that consider the possible dependence of individuals clustered in the same area. Conventional regression analysis techniques assume that individual observations are independent from one another. If this assumption is violated, estimates of the regression coefficients can be biased and standard errors may be underestimated. Multilevel regression techniques make it possible to take into account the possible dependence of the outcome variable among people in the same neighbourhood (Raudenbush and Bryk, 2002; Snijders and Bosker, 1999).

This is accomplished by separating residual variance into two components: (1) residual variance at the individual-level (students), and (2) residual variance at the contextual-level (schools). The latter variance component is constant across individual students in the sample, but random across schools. Estimates produced by this method permit valid tests of statistical significance at both the school- and individual-levels (Raudenbush and Bryk, 2002; Snijders and Bosker, 1999). Outcome variables in this study—low parental monitoring and violent delinquency—were dichotomous and as a result generalized hierarchical linear models with a Bernoulli distribution were estimated for all multilevel analyses (Raudenbush and Bryk, 2002, 291 to 296).

A series of multilevel logistic regression models were estimated to investigate variation in low parental monitoring and self-reported acts of violent delinquency among students attending Toronto schools. As an initial step, for both of these variables 'empty' models (i.e., containing no explanatory variables) provided an estimate of the expected probability of the outcome variables of a student with average background characteristics, as well as an estimate of how much variation in violent delinquency existed among schools. In the second stage of analysis, models assessed whether school variation in either parental monitoring or violent delinquency was associated, separately, with school-level delinquency over and above individual-level gender or grade level. And in a final stage of analysis, a full model assessed whether there was a cross-level interaction between the school-level and the individual-level covariates, or more specifically whether school-level delinquency moderated the relationship between parental monitoring and violent delinquency.

6.3.1 Calculating between-school variation in prevalence of parental monitoring and violent delinquency

Tables 2 and 3 presented low parental monitoring and violent delinquency prevalence rates in an average or 'typical' school in Toronto based on empty model results. The following calculations were undertaken to estimate the average prevalence rates and the corresponding 95% prediction intervals. Using violent delinquency (Table 3) as an example, the expected odds ratio of violence was 0.15, corresponding to an expected log-odds of violent delinquency of,

$$\text{natural log } (0.15) = -1.90.$$

This corresponds to an average school probability of,

$$1/(1+\exp(1.90)) = 0.13, \text{ or roughly, } 13\%.$$

Assuming that schools' log-odds of violent delinquency are approximately normally distributed with a mean of 1.90 and variance of 0.215, it can be expected that 95% of schools have values between,

$$-1.90 \pm 1.96 * \sqrt{0.215} = (-2.793 \text{ and } -0.977).$$

Converting these log-odds to probabilities indicates that about 95% of schools fall between the ranges of 0.058 and 0.274, or about 6% and 27%. For details see Raudenbush and Bryk, (2002, 297).

6.3.2 Odds ratio

When an outcome variable for a regression model has two categories, for example, committing a violent act in the past 12 months versus not doing so, researchers are interested in determining the probability of the occurrence of that event under a particular set of circumstances, for example, being male, having low monitoring parents, or friends who support criminal behaviour. In this case logistic regression is the most appropriate technique to use. An odds ratio is a statistic generated by a logistic regression and can be used to assess whether, other things being equal, individuals with specific characteristics are more or less likely to report some outcome than those in another group, referred to as the reference category. For example, if we consider the risk of violent delinquency for a male in comparison to a female (the reference category), an odds ratio near 1.0 implies there is no difference in violence between the two groups; an odds ratio less than 1.0 implies that those in the group being considered (i.e. males) are less likely to report violence than those in the reference group (i.e. females) and an odds ratio greater than 1.0 implies that those in the group being considered are more likely to report violence than those in the reference category.

6.3.3 Weighting procedures

The variance and standard errors of estimates in the description of study variables for Toronto students (Table 1) were calculated using a set of Bootstrap weights developed by Statistics Canada for the 2006 IYS survey. The bootstrap method is a way of approximating the sampling variance for complex survey designs (Rao and Wu, 1988). For the IYS, a set of 250 student-level bootstrap weights is available. The sampling variance calculation using these weights involves calculating the estimates with each of these 250 weights and then calculating the variance of these 250 estimates.

Since the multilevel analyses in Table 3 take into account two levels of information—individual students nested within schools—a multilevel weighting scheme was required to calculate model parameters (Grilli and Pratesi, 2004; Kovacevic, Huang and You, 2006). In addition to the set of 250 student level Bootstrap weights, an additional 250 weights were calculated for the school-level. Multilevel logistic regression models were run using a new SAS macro, BHLMSAS_V0, developed by Statistics Canada (Pierre and Saidi, 2008).

7 Bibliography

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